

REMARKS

From the Summary page, claims 1-5 and 9-12 were pending. Claims 9-12 are withdrawn from consideration as being directed to a non-elected invention. Claims 1-5 have been rejected. Acknowledgment has been made of Applicants' Claim for Priority. The Information Disclosure Statements filed June 6, 2006 and April 19, 2007 have been considered.

By this response, claims 1 and 3-5 have been amended. Claim 2 has been canceled. No statutory new matter has been added. Support for the amendments can be found in the originally filed specification.

Claim Rejections under 35 U.S.C. § 103 (a)

I. Claim 1 stands rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Endo (US 6,429,518) in view of Redeker et al. (US 5,800,621), Okumura et al. (US 6,093,457) and Endo et al. (6,197,704), along with Schuegraf et al. ("Ultra-thin Silicon Dioxide Leakage Current and Scaling Limit", 1992 Symposium on VLSI Technology Digest of Technical Papers, pp. 18-19) cited as purported evidence of material properties. The rejection as to claim 1 is respectfully traversed.

Amended claim 1 recites,

"A plasma-assisted deposition method for forming an insulating film on a substrate placed on a support device in an airtight processing vessel by activating C₅F₈ gas by a plasma forming gas, the method using a plasma-assisted deposition system and comprising:

radiating a microwave from a plurality of slots in a circumferential arrangement in a flat antenna member disposed opposite to the support device;

guiding the microwave by a wave guide into the airtight processing vessel;

supplying the plasma forming gas, including a rare gas, into the airtight processing vessel with a plasma forming gas discharge head disposed between the flat antenna member and the support device;

supplying the C_5F_8 gas into the airtight processing vessel with a C_5F_8 gas discharge head disposed between the plasma forming gas discharge head and the support device, while conducting the plasma forming gas vertically through a plurality of through holes in the C_5F_8 gas discharge head;

providing an electron temperature of 2 eV or below and an electron density of 5×10^{11} electrons per cubic centimeter or above in a space extending between C_5F_8 gas supply openings in the C_5F_8 gas discharge head and a surface of the substrate;

providing a processing atmosphere **pressure of 19.95 Pa or below;** and

depositing on the substrate the insulating film which is a fluorine-containing carbon film having a **relative dielectric constant of 2.3 or below** and a **leakage current of 5×10^{-8} A/cm² or below.**

Applicants make reference to their exemplary, preferred embodiment as illustrated in FIG. 1 to explain their method of forming an insulating film. Namely, FIG. 1 shows a processing vessel 1 having a flat antenna member 42 with a plurality of slots 46A, 46B formed therein, preferably in a T-shape set, only a short distance apart from one another, on concentric circles or a spiral. See Applicants' PG Publ. 2006/0251828, para. [0040-42]. See also FIG. 3. The flat antenna member is opposite a wafer support device/mount 11. The antenna member radiates a microwave (e.g., circularly polarized) guided via a waveguide 44 into the vessel. Also, there is a plasma forming gas discharge head 2 formed between the antenna member and the support device to supply a plasma forming gas into the vessel. A C_5F_8 discharge head 3 is formed between the plasma discharge head and the support device. The C_5F_8 discharge head has gas supply openings and also has a plurality of through holes which vertically pass plasma there-through. The space between the gas supply openings and a substrate mounted on the support device is maintained at an electron temperature of 2 eV or below, and an electron density of 5×10^{11} electrons per cubic centimeter or above. By activating the C_5F_8 gas in the system as arranged above, and given the specific process conditions of the claimed "space", an insulating

film having a relative dielectric constant of 2.3 or below, and permitting a leakage current of 5×10^{-8} A/cm² or above, can be obtained. See FIG. 6

Applicants urge that the asserted combination does not teach or suggest at least the step of “radiating a microwave from a plurality of slots in a circumferential arrangement in a flat antenna member disposed opposite to the support device” as set forth in amended claim 1. Using such an antenna member and its slot features (from canceled claim 2) distinguishes claim 1 over the cited art. Suzuki was applied in the Office Action as allegedly suggesting the features of claim 2. Applicants respectfully disagree with this assertion. The slots 122 as illustrated in FIGs. 3, 5 and 6 of Suzuki are arranged in a side wall surface of the chamber 101. By contrast, radiating microwaves from Applicants’ slots, as circumferentially arranged in Applicants’ flat antenna member, generates circularly polarized waves. See, for example, FIG. 3. These circularly polarized waves radiate uniformly from the flat antenna member to create an electric field with a uniform electric-field distribution capable of forming uniform, high-density plasma. See para. [0045]. According to Applicants, Suzuki simply fails to teach or suggest such manner of microwave irradiation and therefore cannot disclose their required step of “radiating a microwave from a plurality of slots in a circumferential arrangement in a flat antenna member disposed opposite to the support device” for creating circularly polarized waves, and in turn, uniform, high-density plasma. Further, since the cited art fails to teach this important claim step, Applicants also urge that the cited art would not have disclosed their deposition step rendering an insulating film with the dielectric constant and leakage current properties derived therefrom.

For at least these reasons, the obviousness rejection as to claim 1 must fail. Withdrawal of the rejection as to claim 1 is kindly requested by Applicants.

II. Claims 2-5 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over the art applied against claim 1 in view of Suzuki (US 5,803,975). The rejection as to claim 2 is moot upon cancelation. The rejection as to claims 3-5 is respectfully traversed.

Regarding claims 3-5, Applicants submit that Suzuki fails to teach or suggest the features of base claim 1. Hence, similar arguments as presented herein for claim 1 are advanced to patentably distinguish claims 3-5 over the asserted art. Withdrawal of the rejection as to claims 3-5 is respectfully requested by Applicants.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Therefore, it is respectfully requested that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

It is not believed that extensions of time are required. However, in the event that additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required therefore are hereby authorized to be charged to **Deposit Account No. 02-4300, Attorney Docket No. 033082 M 502.**

Respectfully submitted,
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